

to stimulate more research into the fascinating problem of butterfly migration by long term residents in a given area. Even for Sri Lanka,

where so much more information is on hand, the huge, annual flights remain for all practical purposes a mystery.

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## 22. ON THE OCCURRENCE OF DIMINUTIVE *POEKILOCERUS PICTUS* (FABR.) ADULTS IN NATURE

(With two text-figures)

*Poeciloceris pictus* (Fabr.) commonly known as painted or AK-grasshopper, occurs abundantly on *Calotropis* ('AK' or Akwan) plants in the bed and banks of river Fulgu (Gaya and Bodh-Gaya localities). Though size variations in the adults of this grasshopper have been frequently observed interestingly enough during field collection as well as in laboratory rearings a few adults of both the sexes attracted our attention by virtue of their being of abnormally smaller size. They were hitherto referred as 'diminutive' adults.

Among 235 adult specimens collected from the above localities in the month of June 1975, four diminutive adults were encountered. The sex ratio of these specimens was three males

and one female. They had imaginal coloration but out of four only two (males) possessed fully formed fore and hind pairs of wings and the remaining two individuals (one male and one female) had rudimentary wings which more or less resembled the nymphal wing pads (Fig. 1). They were approximately of the size of a 5th instar nymph. The size of the body of these individuals (♂, 26.00-28.30 mm, ♀, 32.5 mm) compared well with those of the 5th instar nymphs (see Pruthi & Nigam 1939).

In the following year (1976) 250 adults were raised in the laboratory from a stock of 280 nymphs of 3rd to 5th instars collected in the month of June from the same localities. Seven diminutive adult males and one such female

appeared among the normal sized adults. Interestingly enough one diminutive adult male and one female were of extremely small

fully formed fore and hind pairs of wings and were comparable in size with the 5th instar nymphs.

Thus taking into account the numbers of individuals collected from the field and those reared in the laboratory we noted that in a total of 485 adult individuals, 12 were diminutive adults (approx. 2.5%).

The diminutive adult males with fully formed wings were the normal males in every respect but the adult males of the same category with rudimentary wings appeared to be imperfect or immature adults. The former displayed sexual behaviour and mated with the sexually mature females while the later neither exhibited sexual behaviour nor mated with females when kept under observation with females for twenty days. The normal adults of *P. pictus* become sexually mature and undergo mating within a week after fledging (Singh *et al.* 1975 ; Raziuddin *et al.* 1976). The diminutive adult females also did not undergo mating.

The various timely events occurring during the development of insects are regulated by a gradual change in the balance of the moulting hormone (ecdysone) secreted by prothoracic gland and juvenile hormone produced by corpora allata. If this hormonal balance is disturbed by various extrinsic and intrinsic factors abnormalities occur in metamorphosis. Temperature and food are the main factors which produce different effects on the production of hormones and consequently cause upsets in the hormonal balance. Low temperature causes 'metathetly' (juvenile changes) and high temperature 'prothetly' (adult characters) in the larvae of the bug *Rhodnius* (Wigglesworth 1951). In *Leucophaea* (Scharrer 1946) and *Dixippus* (Pflugfelder 1937) alletectomy in earlier instars leads to partial metamorphosis and the production of 'preadultoids' but in *Rhodnius* alletectomy of even first stage larvae led them to metamorphose into miniature adults having well developed



Fig. 1. Photograph showing the relative body size of a female 5th instar nymph (A), diminutive adults—male (B), and female (C). Note the rudimentary wings of the adults.

size ever observed by us (Fig. 2). The size of these two individuals (♂, 22.10 mm, ♀, 27.25 mm) were equal to the 4th instar nymphs (Pruthi & Nigam 1939). They had rudimentary wings. However, out of seven males six possessed

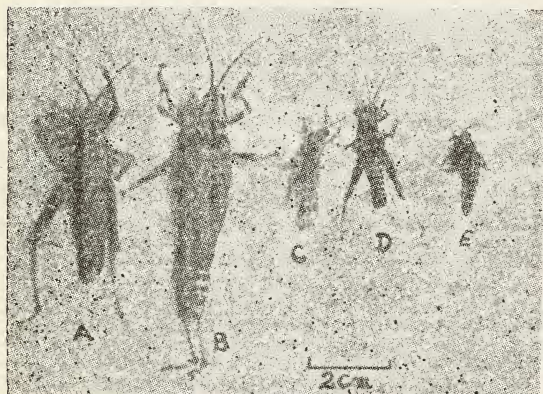


Fig. 2. Photograph showing the relative body size of a normal male (A), normal female (B), 4th instar female nymph (C), diminutive adults—female (D) and male (E). Note the rudimentary wings of the diminutive adults.

adult characters. It is known that grasshoppers will not infrequently miss out a larval stage to produce small sized adults (Wigglesworth, personal communication) but *P. pictus* appear to omit one or more than one nymphal stages and undergo precocious metamorphosis during summer to produce diminutive adults. In fact the case of precocious metamorphosis in *P. pictus* reported in the present communication is very interesting as they were not produced by allectomy in the laboratory but appear in nature on their own under the climatic conditions of hot summer months. The appearance of similar diminutive adults in

laboratory reared stock is clearly a recurrence of the same phenomenon namely of precocious metamorphosis first observed in the field population. A thorough investigation of climatic and nutritional conditions in the field supported by experimental studies in the laboratory are needed to explain under what set or sets of climatic and nutritional conditions, precocious metamorphosis occurs in the population of *P. pictus* in nature.

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## 23. MIXED INFECTION OF LAC

The one problem for any living creature is that of food and in the case of parasites of plants, like the scale-insects, it means host-selection. But until we can rear the insects apart from the tree we shall never be able to know exactly what they feed upon. In view of the many technical difficulties enabling us

to grow lac insects, so to say, in vitro, it was imagined that the symbiotic, yeast-like germ, that lives within the lac insect, would indirectly enable us to know what the insect really gets from the plant. In an article on lac cultivation (1919) I had suggested, supported by several preceding authorities, that probably